Optimization Of Fuel Consumption Using Atmospheric Vertical Air Currents, Phase I

Completed Technology Project (2015 - 2015)

Project Introduction

DynSan proposes to develop a flight controller that will preserve the aircraft trajectory while directing to sources of potential updrafts to optimize fuel consumption of Unmanned Aircraft Vehicles (UAV). Fuel consumption represents a significant factor in powered flight operations; it is desirable therefore to limit the fuel consumption in order to extend an aircraft's flight range and/or flight duration. Glider pilots use their knowledge in micrometeorology to locate and exploit sources of lift. The same soaring techniques could be used with UAV, to exploit atmospheric energy that is renewable. The exploitation of this source of energy can be automated using a controller that will correct the aircraft trajectory in order to optimize the climb rate and thus the average cruising speed. Dynamic soaring is the final source of energy that exploits the differential wind velocity at different heights. In Phase I, we propose to build a map of potential updrafts based on terrain and meteorological conditions and test the validity of this map using actual data extracted from sailplane contests. The data will provide the horizontal and vertical glider speeds; using glider polars will allow us to extract information of the vertical movement of the surrounding airmass. This information will be used by a novel controller that will direct the UAV through locations or rising air, while keeping the aircraft on trajectory to target. The flight of a model UAV through selected topographic and atmospheric conditions will be simulated. Comparisons to actual archived flight data will be made. In Phase II, we will fabricate, program and integrate the developed controller on a real UAV. With the UAV equipped with cameras, it will be possible to visually locate the updraft columns that are marked by fair weather cumulus clouds and manually direct the UAV to such columns. The controller performance in optimizing the aircraft climb rate will then be tested.

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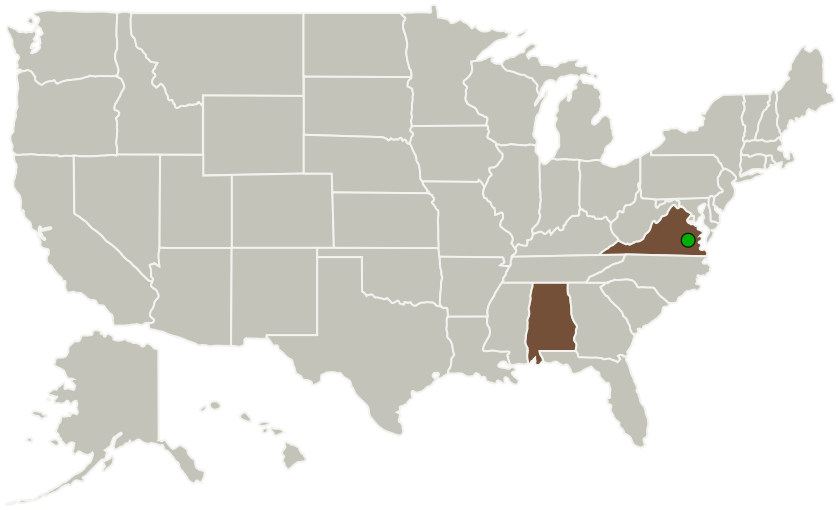
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Dynsan, LLC	Lead Organization	Industry	Madison, Alabama
Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, Virginia

Primary U.S. Work Locations	
Alabama	Virginia

Project Transitions

June 2015: Project Start

December 2015: Closed out

Closeout Summary: Optimization Of Fuel Consumption Using Atmospheric Vertical Air Currents, Phase I Project Image

Closeout Documentation:

- Final Summary Chart Image*(https://techport.nasa.gov/file/139314)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Dynsan, LLC

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

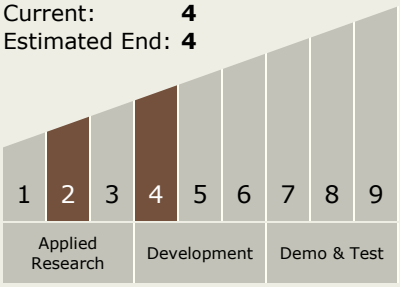
Carlos Torrez

Principal Investigator:

Jean-jacques Malosse

Technology Maturity (TRL)

Start: **2**
Current: **4**
Estimated End: **4**



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Images

Briefing Chart Image
Optimization Of Fuel Consumption Using Atmospheric Vertical Air Currents, Phase I
(https://techport.nasa.gov/image/133559)

Technology Areas

Primary:

- TX15 Flight Vehicle Systems
  - TX15.1 Aerosciences
    - TX15.1.4 Aeroacoustics

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System